

Assessment of patients undergoing therapeutic plasmapheresis

Therapeutic plasmapheresis

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Abstract

Aim: Therapeutic plasma exchange (TPE) is an extracorporeal treatment technique that allows the removal of unwanted substances with large molecule weight from the blood. In this study, it was aimed to retrospectively assess patients who underwent therapeutic plasmapheresis. **Material and Method:** The medical data of patients who underwent TPE in the 10-bed pediatric intensive care unit of Ümraniye TRH between May 2017 and May 2018 were retrospectively assessed. Age, sex, body weight, plasmapheresis indications, plasmapheresis technique, complication and mortality rates were recorded. **Results:** TPE was performed in a total of 19 patients. The mean age of the study population was 8.8 ± 5.9 years. Ten (52.6%) patients were provided respiratory support with mechanical ventilator; the mean duration of ventilator support for these patients was 10.3 ± 10 days. The most common indication for TPE was autoimmune encephalitis with a rate of 42% (8/19 patients); the other indications were: collagen tissue disorder activation, hepatic failure, mitochondriopathic encephalopathy, Guillain-Barre syndrome, septic shock, and hemophagocytic syndrome. The patients were administered totally 5.94 ± 1.69 sessions of TPE, min 3-max 8). As a replacement fluid, fresh frozen plasma (FFP) was used in 17 patients and albumin in 2 patients. The most common complication was catheter-related complications. None of the patients died during the procedure. One patient was followed up for Hashimoto encephalitis and another patient who was followed up for septic shock died. **Discussion:** TPE is a treatment method that is invasive but with low-side effect profile; it is used to stop disease progression in life-threatening autoimmune disorders unresponsive to a medical treatment.

Keywords

Therapeutic Plasma Exchange; Intensive Care; Pediatric

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Introduction

TPE is an extracorporeal treatment method used to remove molecules with large molecular weight from the blood. Plasma and cellular components taken from the patient into the extracorporeal system are separated with a plasma separator; after replacing the removed plasma with albumin, FFP, or crystalloid - colloid combinations, it is recombined with the part of the blood rich in cellular elements, and administered back to the patient. The mechanism of effect of plasmapheresis includes replacing plasma factors, removing inflammatory mediators, reinforcing immune regulation and reticuloendothelial system functions [1]. In this paper, we aimed to discuss the indications and procedural aspects of the TPE procedure among patients who were performed TPE at our pediatric intensive care unit in the light of the available literature data.

Material and Method

In this study, we retrospectively analyzed the medical data of 19 patients who underwent TPE at Ümraniye Training and Research Hospital Pediatric Intensive Care Unit between May 2017 and May 2018. Age, body weight, sex, underlying disease, TPE indication and technique, complications and mortality of the procedure were recorded. TPE was performed using a Fresenius device. All procedures were carried out through a temporary double-lumen hemodialysis catheter placed in a central vein. FFP or 5% albumin was used as the replacement fluid; heparin was used as an anticoagulant. Intravenous calcium replacement was done upon the start of the procedure.

One to 1.5 plasma volume exchanges were done for TPE procedures, procedures were planned daily or every other day.

The statistical analysis of the study data was done with IBM SPSS 22 (İstanbul, Turkey) software package. The descriptive statistics included the number, percentage, mean, standard deviation, minimum, and maximums).

Results

A total of 19 patients were applied therapeutic plasmapheresis, 11 (57.5%) were female and 8 (42.2%) were male. The mean age of the study population was 8.8 ± 5.9 years (min 8 ay-max 17 years); the mean body weight was 32.9 ± 24.6 kg (min10-max 80 kg). Ten (52.6%) patients were provided respiratory support with a mechanical ventilator, with a mean duration of mechanical ventilator support of 10.3 ± 10.1 days (min 2-max 32 days).

The most common indication for plasmapheresis was autoimmune encephalitis with a rate of 42% (8/19 patients). The other indications, in descending order, collagen tissue disorder activation in 10.5% (2/19), hepatic failure in 10.5% (2/19), mitochondriopathic encephalopathy in 10.5% (2/19), Guillain-Barre syndrome in 10.5% (2/19), septic shock in 10.5% (2/19), and hemophagocytic syndrome in 5.2% (1/19) (Table 1).

The patients were administered a total of 5.94 ± 1.69 sessions of therapeutic plasmapheresis, min 3 - max 8). As a replacement fluid, FFP was used in 17 (87.5%) patients and albumin in 2 (12.5%) patients.

The most common complication was catheter-related ones. One patient developed hematoma due to the arterial puncture while another one had blood leakage around the catheter due

Table 1.

Diagnose	n	%
Autoimmune encephalitis	8	42
Collagen tissue disorder	2	10.5
Hepatic failure	2	10.5
Mitochondriopathic encephalopathy	2	10.5
Guillain-Barre syndrome	2	10.5
Septic shock	2	10.5
Hemophagocytic syndrome	1	5.2

to coagulation disorder. Other complications were allergic reactions and hypotension. None of the patients died from TPE procedure. One patient who was followed up for Hashimoto encephalitis and another patient who was followed up for septic shock died, making our mortality rate 10.5% (2/19).

Discussion

TPE is a treatment option for disorders with high morbidity and mortality that are unresponsive to conventional therapies. In order to perform plasmapheresis, the molecule to be removed should be larger than 15.000 D, unremovable by cheap dialytic methods, and have a long half- life [2].

Autoimmune encephalitides are groups of syndrome with a paraneoplastic or immunological etiology, characterized by memory impairment, confusion, and frequent seizures of sub-acute onset [3]. Eight of our patients with autoimmune encephalitis were followed up and received methyl-prednisone and intravenous immunoglobulin as first-step therapy but did not get benefit from these therapies. Of these patients, 6 had clinical improvement after TPE. One patient that did not benefit from TPE received second-step intravenous therapies of rituximab and cyclophosphamide, and improvement was obtained. Unfortunately, we lost our patient with Hashimoto encephalitis, for whom we planned a second-step therapy, due to sepsis.

Guillain-Barre syndrome (GBS) is a subacute polyneuropathy syndrome of autoimmune origin. TPE hastens motor nerve improvement and reduces the duration of ventilatory support [4]. Weiss et al. [5] in a multi-center study reported that GBS was the most common indication for TPE. We carried out two sessions of TPE in two patients and we obtained clinical response. In liver failure, plasmapheresis is recommended to be used with continuous renal replacement therapy [6]. By this way, it is aimed to retain beneficial growth factors and hormones in the circulation, and bilirubin is effectively removed in hyperbilirubinemic patients [7,8]. Two patients admitted with liver failure were administered TPE together with continuous renal replacement therapy; both of them were disconnected from ventilator and transferred to the pediatrics department.

The diagnoses of other patients were hemophagocytic syndrome, mitochondriopathic encephalopathy, septic shock, and collagen tissue disorders (dermatomyositis and SLE).

The most commonly used replacement fluids are FFP and 5% albumin. Fresh frozen plasma carries the risk of hypocalcemia, allergic reaction, and viral infection. Albumin is less allergic and does not contain coagulation factors. When albumin is used, levels of fibrinogen, antithrombin and factor II, V, VII, VIII, IX and X levels are reduced. Among patients with normal

liver function, coagulation factors return to normal within 1-2 days. Fibrinogen levels return to normal by 3-5 days. Therefore, bleeding risk should be kept in mind when albumin is used for plasmapheresis. Fresh frozen plasma is the sole fluid supporting coagulation factors and immunoglobulins. The most common complications of the TPE procedure are hypotension, anemia, hypocalcemia, allergic reactions, and catheter-related thrombosis. The most serious complications are hemostasis disorders due to anticoagulation therapy, hypotension requiring catecholamine infusion, problems related to the central venous catheter, and arrhythmias [9]. In a study published in 2007, it was reported that the complication rate was higher among pediatric patients compared to the adults [10]. Basic et al. [11] assessed 4857 TPE among 509 patients reported a rate of 0.12% for life-threatening complications; they also added that none of them died from TPE procedure itself. One of our patients developed hematoma from arterial puncture while another one had leakage around the catheter due to coagulation disorder. A girl with the diagnosis of systemic lupus erythematosus that underwent TPE for hemolytic anemia developed allergic reaction and thus was administered 5% albumin as a replacement fluid in the subsequent sessions.

Tolunay et al. [12], in a study whereby they assessed patients with neurological disorders undergoing plasmapheresis, reported that they most commonly encountered hypotension at a rate of 29.2%, followed by fever and allergic reactions with a rate of 9.7% and hypertension with a rate of 4.8%.

We are of the opinion that making a correct indication, selection of a correct replacement fluid, and the team having experience in the procedure is equally effective in procedural success. Plasmapheresis is a treatment method that is invasive but with low-side effect profile; it is used to stop disease progression in life-threatening autoimmune disorders unresponsive to medical treatment.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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